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Abstract. Our objective is to test the influence of information asymmetry between potential buyers on the premium paid for an acquisition. We analyze mergers and acquisitions as English auctions with asymmetric information. The theory of dynamic auctions with private values predicts that more informed bidders should pay a lower price for an acquisition. We test that prediction with a sample of 1,026 acquisitions in the United States between 1990 and 2007. We hypothesize that blockholders of the target's shares are better informed than other bidders because they possess privileged information on the target. Information asymmetry between participants is shown to influence the premium paid. Blockholders pay a much lower conditional premium than do other buyers (around 70% lower). Tests also show that the characteristics of the target, specifically the runup, sales growth and size, affect the premium. The size of the target relative to the buyer, the choice of a public takeover bid and the hostility of the bid are also influential.

Keywords. Asymmetric information, merger and acquisition, blockholder, premium, English auction, test for over-identifying restriction (Sargan test), test for endogeneity (Durbin-Wu-Hausman test).

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1. Introduction

Mergers and acquisitions have prevailed in economies around the world for several decades. The scope of this phenomenon varies from year to year. Three main waves of acquisitions have been over the recent years, culminating in 1989, 1999 and 2007. The last wave that started in 2003 is characterized by the increasing presence of companies from emerging markets.

Acquisitions are an interesting growth avenue for many companies. Potential economies of scale, vertical integration, synergies or tax savings propel organizations to opt for this form of growth. Companies often disburse exorbitant amounts to acquire a target. Betton, Eckbo and Thorburn (2008) find that the average premium paid for American acquisitions between 1980 and 2002 equals 48% of the market value of the target before the initial bid, and some premiums even exceed 100%. The high prices disbursed do not always yield the anticipated outcome because some companies tend to overvalue the potential of the transaction.

The recent literature that has attempted to identify the determinants of the premium paid during an acquisition has concentrated on the characteristics of the target, the buyer and the transaction. These studies find that the premium paid is influenced in particular by the size of the company, the debt level, the hostility of the transaction and the payment mode. However, consensus has rarely been reached concerning the various factors examined.

Fishman (1988) proposes that the acquisition process is highly similar to an auction in an asymmetrical information environment. Two previous empirical studies of auctions demonstrate the significant impact of information asymmetry on the price the winner pays. Hendricks and Porter (1988) conclude that information asymmetry between the participants in auctions on drainage tracts for oil and gaz decreases the price paid by the winner when the player's valuation is limited to the common value of the good. Conversely, Dionne, St-Amour and Vencatachellum (2009) contend that information asymmetry drives an increase in the price paid by the winning bidder of a slave auction when the valuation includes a common component and a private component. Thus, information asymmetry should have a real impact on the auction bids and should influence the premium paid during a transaction.

The objective of this article is to empirically test the influence of several determinants of the premium identified in the literature on mergers and acquisitions by looking closely at a previously unexplored factor: information asymmetry between potential buyers. The theoretical literature related to acquisitions underlines the importance of examining whether such asymmetry influences the premium paid (Dasgupta and Tsui, 2004; Ravid and Spiegel, 1999; Fishman, 1988). The empirical literature emphasizes the role of toeholds (acquisition of target shares) in generating information (Betton et al., 2000, 2009). We do not follow this line of research because toeholds do not necessary possess more information than the market on targets. Instead, we analyze the role of blockholders[1] of the target's shares. As documented in the recent literature, the monitoring activities of blockholders give them preferred access to managers and board members, and hence a distinct information advantage to evaluate the performance and fair value of the target (Heflin and Shaw, 2000; Brockman and Yan, 2009; Kang and Kim, 2008; Edmans, 2009).

Kang and Kim (2008) show that block acquirers prefer geographically proximate targets: observed ratio of firms acquired by blocks located in the same state is 20%, whereas only 7% of all U.S. public firms are acquired by a buyer residing in the same state. Another interesting result in this study for our purpose is that geographic proximity is an important factor to explain incentives to perform an active governance role in targets and to develop information asymmetry, which corroborates Brockman and Yan (2009), Chen et al. (2007), and Edmans (2009). Edmans (2009) also documents that blockholders encourage managers to take actions that increase long-run value or to undertake investments that increase fundamental value. Our research question is: How do these better informed bidders influence the premium paid in mergers and acquisitions?

We also differ from the empirical literature on mergers and acquisitions by using auction theory to derive the pricing implication from the presence of informed bidders. Our main contribution is to test for the presence of asymmetric information by extending recent empirical methodologies developed for other types of auctions. We instrument the blockholders variable because its

[1] A block of shares is a proportion of the shares that represents at least 5%. Buyers with a proportion of shares of less than 5% are less likely to possess privileged information.

presence in the bid could be endogenously determined. We use more than one instrument for the presence of blockholders in the auction so we can test whether the instruments are truly exogenous and confirm the relevance of instrumental variables in explaining the presence of blockholders. These instrumental variables are presented in Section 5.

An additional contribution of our research is the sample that we have formed. It comprises 1026 takeover transactions in the United States between 1990 and 2007. Notably, the sample is recent and we have compiled accounting data on the target and the buyer, data related to the acquisition process and data concerning changes in the share price of the two parties to the transaction. This sample allows us to include several explanatory variables related to the premium paid in our econometric model, which contributes to the richness of our results.

The paper is structured as follows. Section 2 describes the influence of information asymmetry in the auction context. Section 3 presents the theoretical model. Empirical implications of the theory are also discussed. Section 4 contains the review of the empirical literature on the determinants of the premium. Section 5 specifies the econometric models used, along with the database and descriptive statistics for the variables. Section 6 presents and analyzes the results, and the robustness tests are found in Section 7. Section 8 concludes the paper.

2. Acquisitions and information asymmetry

2.1. Acquisition perceived as an auction

Several authors agree that the acquisition process is quite similar to that of the Japanese version of an English auction (Fishman, 1988; Ravid and Spiegel, 1999). Other authors model the acquisition as a sealed-bid second-price auction. Notably, Burkart (1995) and Rhodes-Kropf and Viswanathan (2004) endorse this view of the acquisition because such auctions are quite malleable and easier to analyze than the English auction.

Even though acquisitions do not always involve several potential buyers, researchers still characterize them as auctions. One possible explanation for this was proposed by Fishman (1988), who models the acquisition as costly in an asymmetrical information environment. He

asserts that acquisitions including a single participant can be considered auctions in which the other interested participants are not manifested.

2.2. Information asymmetry in sealed-bid auctions

The theoretical literature on sealed-bid auctions with information asymmetry began with Wilson (1967). He analyzed the sealed-bid auction with information asymmetry when the good is valued uniquely according to its common value (absence of private value). The common value includes the elements that are pertinent for all participants that appraise the good at auction. Thus, in terms of common value, the players weigh the same elements (such as productivity or profits) but may value the object differently. Information asymmetry exists because one participant holds more precise private information on the value of the good. Wilson (1967) showed that the more informed party has a much higher marginal expected return than the uninformed competitors.

Weverberght (1979), Milgrom and Weber (1982), and Engelbrecht-Wiggans, Milgrom and Weber (1983) revisit the problem and propose a different version of the equilibrium premium. They predict that the informed participant's anticipated profit is generally positive, whereas the expected profits of the other players are zero. The fear of the winner's curse (winning by bidding a too high price) prevails among uninformed players. Informed participants can then win the auction at a lower price.

Hendricks and Porter (1988) test this main prediction of the theoretical literature on sealed bid auctions with common value in a context of information asymmetry. Their analysis of auctions of drainage tracts for oil and gas between 1959 and 1969 indicates that companies adjacent to the tract being sold hold superior information because of the exploration they do on their own land. They are therefore better informed than the other firms. The empirical results strongly support the prediction of the theoretical model. The returns of more informed firms are positive while those of less informed firms are negligible.

2.3. Information asymmetry in English auctions

The influence of information asymmetry in English auctions has also intrigued researchers. Hernando-Veciana and Tröge (2004) analyze an English auction with information asymmetry and distinguish common value from private value. They study the uninformed participants' behavior during the auction when the party that holds privileged information is present. They conclude that the uninformed bidder's strategies are mainly dictated by the interaction between the winner's curse and the loser's curse (losing by bidding too low). The uninformed participant may deduce that the informed player remains active because the common value is high. Thus, the former remains at the auction to avoid the loser's curse. Conversely, the uninformed participant may believe that the informed bidder remains in the auction because he has high private value. In this case, the uninformed bidder leaves to avoid the winner's curse. The authors argue that the probability of loser's curse is markedly higher than the probability of winner's curse among uninformed participants that have high private value. Uninformed bidders protect themselves from the loser's curse by submitting aggressive offers when an informed competitor is present. Informed players must then bid a large amount to discourage the other participants and win the auction.

Dionne, St-Amour and Vencatachellum (2008) extend the empirical model developed by Hong and Shum (2003) and derive the empirical implications of the presence of an informed participant in an English auction with private and common value. In their model, the informed player makes an overall valuation because the common value cannot be distinguished from the private value. Dionne, St-Amour and Vencatachellum (2008) conclude that the presence of an informed participant prompts more aggressive offers by uninformed players. They also confirm the competition-dampening impact of informed bidding (Engelbrecht-Wiggans et al., 1983) in a special case of their model where private values are on average zero. They conclude that private valuation contributes significantly to the enhancing effect of the winning bid.

Dionne, St-Amour and Vencatachellum (2008) test their theoretical predictions on a sample of slave auctions in Mauritius between 1825 and 1834. They hypothesize that a familial relationship between the buyer and seller grants the buyer privileged information about the slave. Their results

are consistent with the auction model when private valuations are taken into account because the equilibrium price is higher when the informed player wins the auction.

To summarize, in the pure common value context (in either English or sealed-bid auctions), the presence of information asymmetry between the participants lowers the price paid by the informed player if that player wins the auction, because of the winner's curse. Inversely, in English auctions with common and private value, information asymmetry may raise the price paid by the informed player if that player wins the auction, when the loser's curse prevails. The presence of private value along with asymmetric information therefore seems to influence the results considerably. In the following sections, we adopt the English auction interpretation of the acquisitions process.

2.4. Privileged information of blockholders

Information asymmetry between the bidders at an auction seems to influence the price paid by the winner considerably. If the target object at an auction is a complex good such as a company, the participants probably use disparate information to evaluate the target, which will affect the premium paid by the buyer. Several recent studies show that information asymmetry is manifested in a company when its ownership structure includes blockholders and diffused shareholders (Heflin and Shaw, 2000; Brockman and Yan, 2009; Kang and Kim, 2008; Edmans, 2009). These shareholders have an advantage when appraising the performance and the fair value of the target.

3. Theoretical model

The theoretical model that corresponds to our empirical analysis is a particular case of the model proposed by Dionne et al. (2009). We consider an open-bid, single-good, ascending auction with common value and potential private value. As in Wilson (1998), we restrict the auction model to the Japanese version of the English ascending auction where the dropping-out decision is public and irrevocable. Some bidders may have private preferences regarding some targets but we

assume that, on average, these preferences are not significant for mergers and acquisitions. One important assumption is related to the presence of asymmetric information across bidders.

Let us assume that the stochastic process is log normal. The total valuation of a target firm by bidder *i*, V_i, can be written as $\log(V_i) \equiv v_i$ as well its log signal, $\log(X_i) \equiv x_i$. We assume that:

$$v_i = a_i + v \tag{1}$$

$$x_i = v_i + \varepsilon_i \tag{2}$$

where:

$$[a_i, v, \varepsilon_i] \square \text{ N.I.D.}\left([0, m, 0], \text{Diag}\left[t_i^2, r_o^2, s_i^2\right]\right). \tag{3}$$

The total valuation of a target by agent *i* is the sum of private value a_i and common value *v*; its signal x_i is a random variable. All random variables are assumed i.i.d. Gaussian with $t_i^2\left(r_o^2\right)$ the variance of the private (common) value and s_i^2 the variance of the signal. All distribution parameters are common knowledge. One bidder (I) has more information than other bidders. This bidder can be identified by all other bidders and asymmetric information is introduced by assuming a more precise signal for bidder $I: s_i = 0$ for $i = I$ and $s_i > 0$ for all other bidders.

Our model differs from the pure common-value model $(a_i = 0, \forall_i)$ of Engelbrecht-Wiggans et al. (1983) and Hendricks and Porter (1988) by allowing some agents to have private valuations of the target. This additional flexibility does not affect the empirical prediction that the more informed agent should pay a lower price when he wins the auction but allows the possibility that some agents may have private valuation. It also supports a more general empirical model. If one observes empirically that more informed agents pay a positive premium, this would mean that private values are important in this market and that $\overline{a}_i$ is positive in line with the model of Dionne et al. (2009) and contrary to the above assumption that $(\overline{a}_i = 0)$.

Hong and Shum (2003) derived the equilibrium bid of agent *i* at round *k* under the log-normal assumption:

$$b_i^k = \frac{1}{A_i^k}\left(x_i + D_i^k x_d^k + C_i^k\right) \tag{4}$$

where A_i^k, D_i^k and C_i^k are functions of the distributional parameters t_i, m, r_o, s_i and x_d^k is the observable vector of signals from exited bidders at round k. Dionne et al. (2009) designed a Monte-Carlo experiment to compute the private information premium of agent i, at round k and Monte-Carlo experiment j:

$$\pi(i,k,j) = b_i^k(j,1) - b_i^k(j,0) \tag{5}$$

where $b_i^k(j,1)$ is computed when an informed bidder is present in the auction and $b_i^k(j,0)$ is computed without an informed bidder. One can verify that the informed agent never lets uninformed agents win at a price lower than the common value when the private value is not important $(\bar{a}_i = 0)$. Consequently, the premium for the informed agent is non-positive.

As mentioned above, the theory predicts that the direction of the influence of information asymmetry on the premium depends on the inclusion of a private value component in the valuation of the target. Below we will test whether information asymmetry significantly influences the premium. We will then analyze the direction of this impact to determine the type of valuation the buyers perform. We anticipate a significant negative influence on the premium if no significant private value is attributed to the target.

4. Empirical literature on mergers and acquisitions

4.1. Premium

We study takeovers in general, which include acquisitions in which the buyer holds the majority of the shares of the target after the transaction. We are interested in the final price the buyer pays to take control of the target. The price paid notably reflects the potential of the target and the negotiating power of the parties to the transaction.

The premium is the measure of the auction outcome. Gondhalekar, Sant and Ferris (2004) analyze the premiums paid by buyers during a period that covers three decades, mainly 1973 to 1999. The authors define the premium as the difference in percentage between the final price and

the share price of the target 40 days before the announcement of the offer. They estimate the average premium for their entire sample at 53%. However, the premium varies considerably, ranging from a maximum of 103% in 1976 to a minimum of 22% in 1991.

Given that the *runup* (see the definition below) in the share price of the target is manifested mainly after the 42nd day before the announcement (Schwert, 1996), we use the price on this date as the reference price to set the premium because it reflects the value the shareholders attribute to the company before the rumors. We therefore define the premium as follows: $ln\ (Final\ price / Price_{-42})$ where $Price_{-42}$ represents the share price of the target, adjusted for splits and dividends, on the 42nd day before the announcement. This definition was also used by Betton, Eckbo and Thorburn (2008).

4.2. Determinants of the premium

Several studies have sought to identify the factors that influence the price paid in a takeover transaction. Knowledge of these factors is crucial because it allows the parties to the transaction to set the fairest price possible. The determinants analyzed in the literature are mainly related to the characteristics of the target, the buyer and the transaction.

Runup

To measure the *runup* effect, Schwert (1996) estimates the *runup* as the cumulative abnormal return on the target's stock over a two-month period before the announcement. The lowest estimate implies that at least 67% of the run-up is added to the total price paid to acquire the target. Thus, a higher runup is associated with a higher premium paid to acquire a target. Betton, Eckbo and Thorburn (2009b) also examine the impact of the runup on the premium paid during an acquisition. They model the runup as the logarithm of the ratio of the share price of the target on the day before the announcement to the share price 42 days before the announcement. They conclude that the higher the runup, the higher the premium paid to acquire the target. An increase of $1.00 of runup creates an average premium increase of $0.80.

Like Schwert (1996), we use the cumulative abnormal return over a two-month period before the announcement to reflect the *runup* in the share price of the target. First we estimate, for each target, a model that links the return of the target (R_{it}) to the return of the S&P 500 index (R_{mt}), for a period ranging from the 379th day before the announcement until the 64th day before the announcement: $R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$ where t = -379 to -64. Using the estimated alpha and beta coefficients, we compute the error term of the market model for each target, for each day of the two-month period before the announcement. The error term corresponds to the abnormal return: $\varepsilon_{it} = R_{it} - \hat{\alpha}_i - \hat{\beta}_i R_{mt}$ where t = -42 à -1. The *runup*, i.e. the cumulative abnormal return, is computed by summing the error terms: $Runup_i = \sum_{t=-42}^{-1} \varepsilon_{it}$. We posit that the premium a buyer pays increases with the runup of the share price of the target, which is consistent with the markup price effect identified by Schwert (1996).

Market-to-book ratio of the target

The *market-to-book* ratio is used in the literature to represent new growth opportunities for companies. Thus, buyers pay more for a target with a high *market-to-book* ratio because it offers new investment opportunities. Gondhalekar, Sant and Ferris (2004) test this hypothesis but do not obtain significant results. Betton, Eckbo and Thorburn (2008) assert that if the market-to-book ratio of the target is higher than the median ratio of the industry, the target is a growth company relative to its competitors and should therefore command a higher premium. They find that a market-to-book ratio higher than the industry median is associated with a 3% increase in the premium. Comment and Schwert (1995) obtain a lower premium because some bidders may be attracted by firms that are underevaluated by the market.

We include the market-to-book ratio of the target in our analysis. We define market value as the product of the share price and the number of common shares outstanding. The book value of the company corresponds to the book value of common equity. We calculate this ratio at the end of the most recent fiscal year before the announcement of the transaction. The impact of this ratio on the premium is ambiguous. A negative relation should be anticipated between the market-to-book ratio and the premium if a low ratio illustrates the undervaluation of the target, whereas a positive

relation between the market-to-book ratio and the premium should be seen if a low ratio signals restricted investment opportunities.

Sales growth of the target

The past performance of the target may have two opposite effects on the premium. First, buyers may be interested in targets that perform poorly because of the gains that could be realized if the current managers were replaced. In this case, the relation between the performance of the target and the premium is negative. Schwert (2000) analyzes the influence of past performance on the premium paid and obtains a negative but nonsignificant coefficient. Second, poor performance is often associated with fragile financial health, and is therefore likely to hinder the target's ability to negotiate. The relation between performance and the premium is thus positive. Like Bange and Mazzeo (2004), we measure past performance by sales growth during the fiscal year before the announcement of the offer, defined as:

$$(Total\ sales_t - Total\ sales_{t-1})/Total\ sales_{t-1}$$

where t represents the most recent fiscal year before the announcement. This choice is based on the empirical evidence provided in Lakonishok, Shleifer, and Vishny (1994, p. 1550), who measured past growth by growth in sales because sales is a less volatile variable than either cash flow or earnings.

Company size

The literature identifies two main variables that have been used to analyze the influence of company size on the premium paid. Some authors consider the size of the target directly, whereas others opt for a ratio of the size of the target to that of the buyer. Schwert (2000) and Comment and Schwert (1995), among others, use a direct measure of the target size and conclude that this variable has a significant negative effect on the premium because larger targets are associated with higher integration costs. Gondhalekar, Sant and Ferris (2004) and Moeller (2005) study a relative size variable and report an adverse effect of target size on the premium.

Consistent with Comment and Schwert (1995), we measure the target size as the logarithm of the total assets, and employ this variable at the end of the most recent fiscal year before the bid. We also use a ratio of the size of the target to that of the buyer. Specifically, the relative size is calculated by comparing the market value of the shares of the target to the market value of the buyer's stock. The market values are obtained at the start of the runup period, namely two months before the announcement. We assume that the size variables are negatively linked to the premiums paid by the buyer.

Financial synergies

The debt level of the parties to the transactions illustrates their financial health. Gondhalekar, Sant and Ferris (2004) propose that the buyer's leverage can influence the premium paid. Considerable leverage will probably be associated with closer monitoring of the company's operations by creditors. Creditors will, in turn, try to prevent the buyer from paying an overly high premium. They identify a significant negative influence of the buyer's debt ratio on the premium paid. A target that has considerable debt is less attractive, and the premium paid to obtain it is putatively lower. We therefore predict a negative influence of the two parties' debt ratio on the premium paid. We estimate the debt level, for each of the parties to the transaction, as the ratio of long-term debt to total assets at the end of the most recent fiscal year before the announcement of the acquisition.

Governance of the buyer

The price paid during an acquisition can also be dictated by the buyer's hubris or agency problems. The hubris hypothesis, introduced by Roll (1986), stipulates that managers that possess exaggerated self confidence overestimate their ability to manage the target, which leads them to pay considerable amounts to acquire it. Hayward and Hambrick (1997) examine the influence of hubris of the CEO on the premium paid during large acquisitions. Hayward and Hambrick (1997) confirm that hubris is associated with a higher premiums paid.

We use the return on the buyer's stock for a six-month period before the runup period, namely the return adjusted for splitting and dividends between the eighth and second month before the announcement. We thus posit that the recent performance of the organization, which leads managers to overestimate their ability to manage the target, is positively associated with the premium paid.

Agency problems can also influence the acquisition process. Such conflicts occur when the buyer's managers use the company's free cash flows to undertake projects that generate few profits for shareholders, consistent with Jensen (1986). Gondhalekar, Sant and Ferris (2004) argue that one implication of agency problems is that buyers characterized by a low market-to-book ratio but large free cash flows will favor more aggressive acquisition approaches and therefore pay higher premiums. They analyze the impact of free cash flows and investment opportunities on the premium individually using linear regressions, and conclude that large cash flows positively influence the premium, which supports the idea that managers decisions' occasionally serve to maximize their own interests. Further, the buyer's investment opportunities are inversely related to the premium paid.

To analyze the impact of governance problems, we include the buyer's free cash flows. Managers can use these cash flows to purchase a company at a high price, to serve their own interests. We expect a positive relation between the premium paid and the ratio of free cash flows to total assets. This ratio is obtained for the fiscal year immediately preceding the transaction. Free cash flows are estimated as the operational income before depreciation, less total income taxes, changes in taxes and deferred investment credits, interest expenses and dividends on preferred and common stock.

Company managers that possess considerable free cash flows are more likely to pay a higher premium if investment opportunities are limited. Consequently, we include the market-to-book ratio of the buyer's assets at the end of the most recent fiscal year before the bid to control for growth opportunities. The numerator represents the market value of the assets, which is calculated as the book value of the assets, from which we subtract the book value of the equity

and add the market value of the equity. The denominator is defined as the book value of the assets. We predict a negative influence of the buyer's market-to-book ratio on the premium.

Hostility

A target that receives a takeover bid can either accept the transaction or reject it aggressively. Schwert (2000) maintains that a hostile reaction is intended to prevent the acquisition or initiate negotiation of a better offer. Accordingly, hostility is a negotiation strategy intended to increase the price the buyer pays. He also affirms that the hostile reaction is intended to decrease the probability of success of the transaction. Nonetheless, the author concludes that a manifestation of hostility seems to be mainly linked to strategic negotiation. Using the definition of hostility proposed by SDC Platinum, Moeller (2005) finds that hostile transactions command a higher premium.

We use one of the five definitions put forth by Schwert (2000) to characterize the hostility of the transaction. We create an indicator variable that takes the value of 1 when the transaction is defined as hostile according to SDC Platinum. This database defines a hostile transaction as an unsolicited offer that the board of directors of the targets rejects. We anticipate a positive relation between hostility and the premium in line with Schwert's (2000) assertion that hostility is a negotiation strategy intended to increase the price paid by the buyer.

Buyer's strategies

Potential buyers may choose to either negotiate with the managers of the target or to make a tender offer to shareholders. Public takeover bids do not require approval by the board of the target and are therefore quicker. Betton, Eckbo and Thorburn (2008) identify a 6.1% drop in premium if potential buyers decide to make a public takeover offer rather than negotiate with managers. Moeller (2005) also reports that a public purchase offer has a negative impact on the premium, whereas Comment and Schwert (1995), Schwert (2000) and Bange and Mazzeo (2004) obtain a positive influence for a public offer. We use an indicator variable with a value of one for a public takeover offer and do not predict a net effect.

Potential buyers also choose the payment method. Slusky and Caves (1991), Comment and Schwert (1995, 2000) and Betton, Eckbo and Thorburn (2008) conclude that a wholly cash payment, which implies a prominent tax effect, increases the premium significantly. We control for the process by creating an indicator variable that equals 1 if the transaction is fully paid in cash. The influence of this variable on the premium paid is assumed to be positive.

The presence of more than one potential buyer creates competition that could increase the premium that the target could obtain from the buyer. We consequently include an indicator variable that equals 1 if a third party has submitted an offer for the target while the first buyer's offer is still pending. We predict a positive relation between the presence of several buyers and the premium.

Information asymmetry

The Blockholders variable is used to measure the effect of information asymmetry. We therefore capture the information asymmetry between bidders by identifying the buyer that holds a block of the target's shares before making the offer. The purchase of a block of shares is public information because it requires buyers to complete a report with the *Securities and Exchange Commission* (SEC) describing their intentions. The public nature of our information asymmetry variable is crucial because we assume, as in an English auction, that the informed participant's identity is known by all the players. We thus predict a significant relation between the premium and blockholders.

The Blockholders variable is equal to 1 if the buyer holds a block (more than 5%) of the target's shares before making the offer. If this variable is significant, our result corroborates the theory that information asymmetry between potential buyers plays an important role in determining the premium. By analyzing the sign of this significant coefficient, we can deduce whether the buyers include a private component in their valuation of the target. A negative sign would imply an absence of private value. We also instrument the Blockholders variable as discussed in the next section. Table 1 summarizes the above discussion.

Table 1: Description of independent variables

This table presents the independent variables of our study, the hypotheses about their influence on the premium paid and the method used to construct the variables. All accounting ratios were estimated from data gathered at the end of the most recent fiscal year before the announcement of the offer. Data sources are also indicated.

Independent variable	Predicted sign	Construction method and data source
1) Target		
Runup	+	Cumulative abnormal return on the period ranging from the 42nd day before the announcement to the last day before the announcement. Source: CRSP
Market-to-book	Uncertain	Number of common shares outstanding (Compustat #25) × Share price (Compustat #24)/Book value of equity (Compustat #60).
Sales growth	Uncertain	Total sales (Compustat #12) at time t – Total sales at time t – 1/Total sales at time t – 1 where t represents the end of the most recent fiscal year before the announcement of the transaction
Size	–	Logarithm (Total assets (Compustat #6))
Leverage	–	Long-term debt (Compustat #9)/Total assets (Compustat #6)
2) Buyer		
Return on stock	+	(Buyer's share price 42 business days before the offer – Buyer's share price 168 business days before the offer)/Buyer's share price 168 business days before the offer. Source: CRPS
Free cash flows	+	Operating income before depreciation (Compustat #13) – Total income taxes (CST #16) – Change in tax credits and deferred investments (CST #35) – Interest expenses (CST #15) – Preferred dividends (CST #19) – Common dividends (CST #21)/Total assets (CST #6)
Market-to-book	–	Total assets (Compustat #6) – Book value of equity (CST #60) – Number of common shares outstanding (CST #25) × Share price (CST #24)/Total assets (Compustat #6)

Independent variable	Predicted sign	Construction method and data source
Relative size	–	(Target: Number of common shares outstanding (CST #25) × Share price 42 days before the announcement (CRSP))/ Buyer: Number of common shares outstanding (CST #25) × Share price 42 days before the announcement (CRSP))
Leverage	–	Long-term debt (Compustat #9)/Total assets (Compustat #6)
3) Transaction		
Public purchase offer	Uncertain	Indicator variable that takes the value of 1 if the transaction is in the form of a public purchase offer
Cash payment	+	Indicator variable that takes the value of 1 if the transaction is fully paid in cash
Hostility	+	Indicator variable that takes the value of 1 if SDC Platinum describes the offer as hostile.
Multiple players	+	Indicator variable that takes the value of 1 if a third party has submitted an offer for the target whereas the first buyer's offer is still pending
4) Information asymmetry		
Blockholders No private value	Non-zero –	Indicator variable that takes the value of 1 if the buyer owns at least 5% of the shares of the target before the announcement. Note that this variable is also instrumented.
5) Instrumental variables discussed in Section 5		
Intrastate	+	Indicator variable that takes the value of 1 if the target and the blockholders are from the same state (Compustat).
Regulated industry	+	Indicator variable that takes the value of 1 if the target is regulated (SIC code begins with 4 or 6).
Intrastate*performance	–	Variable equal to the product of targets' performance and a dummy variable indicating that the target and the blockholders are from the same state. Performance of the target is measured by Operating income before depreciation (Compustat #13)/Total assets (Compustat #6).

5. Methodology

In this section we specify the econometric models used in the study. We describe our sample in detail and present descriptive statistics of the premium and the independent variables of our model.

5.1. Econometric models

We estimate the influence of determinants of the premium identified in the previous section using the ordinary least squares method. Our model is expressed as follows:

$$\begin{aligned} Premium_i = {} & \beta_0 + \beta_1 Runup_i + \beta_2 TMarket\text{-}to\text{-}book_i + \beta_3 TSales\ growth_i + \\ & \beta_4 TSize_i + \beta_5 TLeverage_i + \beta_6 BReturn\ on\ Stock_i + \beta_7 BFree\ cash \\ & flows_i + \beta_8 BMarket\text{-}to\text{-}book_i + \beta_9 BRelative\ size_i + \beta_{10} BLeverage_i + \beta_{11} Public \\ & Offer_i + \beta_{12} Cash\ payment_i + \beta_{13} Hostility_i + \beta_{14} Multiple\ players_i + \beta_{15} Blockholders_i + \mu_i \end{aligned} \quad (6)$$

where T is for target and B is for the winning bidder.

The test for the null hypothesis of no information asymmetry is $\beta_{15} = 0$. The variable of interest to test for the presence of information asymmetry may be correlated with the unobservable factors in (6), and ordinary least square estimates may be biased. Blockholders may submit bids because they want to be more active in a particular industry and the current offer by a competitor may reduce this opportunity. One way to reduce potential bias is to instrument the Blockholders variable by adding exogenous variables to the vector of explanatory variables and by using the 2SLS method of estimation for the two equations. We choose to use a linear regression for the first stage because the first-stage functional form does not affect the consistency of the second-stage estimates (Angrist and Kuerger, 2001). We also estimate the logit regression for robustness analysis.

The additional explanatory variables must be correlated with Blockholders$_i$ and not correlated with the error term in (6). They must explain the probability that blockholders win the auction and should not influence the premium directly.

We use three variables to instrument the presence of blockholders in the target: 1) Intrastate; 2) Regulated industry; 3) An interaction variable between Intrastate and performance of the target. The first variable comes from the contribution of Kang and Kim (2009). They document that blockholders prefer targets in the same state because proximity reduces the transaction costs of activities yielding higher returns. They also show that the monitoring of intrastate firms is more valuable for targets that have greater asymmetric information such as targets with poor past performance. Blockholders are consequently more likely to buy shares in intrastate underperforming firms to better exploit their informational advantage. We assume that blockholders are more present in poorly performing targets of their state because they have a higher probability of obtaining long-run value by exploiting asymmetric information with other competitors. The other variable controls for the fact that the industry of the target is regulated. Blockholders should better exploit their informational advantage for these firms because they are more knowledgeable about the different laws regulating the target. As pointed out above, these three variables must be correlated with the probability that blockholders win the auction but should neither directly affect the premium nor be correlated with the residuals of the premium equation. Because three instruments are examined, we can apply two formal tests to verify the desired result: the Sargan test for the over-identifying restrictions (the instruments are truly exogenous) and the Durbin-Wu-Hausman test for the relevance of instrumental variables method (or the endogeneity test). We test that Intrastate, Regulated industry, and Intrastate* performance are relevant instruments in the Blockholders equation.

We perform two additional analyses to confirm the validity of the result attributable to the information asymmetry variable. First, we reproduce the test by Dionne, Gouriéroux and Vanasse (2001).[2] These authors show that a significant influence of information asymmetry can be obtained in (6) because of the poor specification of the model or the presence of nonlinearity. It is possible to avoid these problems by adding the predicted probability of a potential buyer's being informed as an independent variable in the initial econometric model. We therefore test the following model:

[2] Other recent empirical tests include Chiappori et al. (2006); Cohen (2005); de Meza and Webb (2001); Fang et al. (2008); Finkelstein and McGarry (2006); Finkelstein and Poterba (2006); Hendel and Lizzeri (2003). See Cohen and Siegelman (2010) for a recent survey.

$$Premium_i = \beta_0 + \beta_j X_i + \beta_{15} Blockholders_i + \beta_{16} E(Blockholders_i | Z_i) + \varepsilon_i \qquad (7)$$

where X_i represents the independent variables that predict the premium in our initial model, excluding the Blockholders$_i$ variable, and Z_i represents the independent variables used to predict the probability that a buyer holds at least 5% of the target's shares before the announcement of the offer (not instrumented). We used the Logit model to estimate the probability that a player is a blockholder. Again, $\beta_{15} = 0$ tests for the absence of information asymmetry.

We further validate the influence of information asymmetry using the non-parametric test proposed by Chiappori and Salanié (2000). Specifically, we estimate the logit equation mentioned above along with (6), excluding the Blockholders variable. If the premium paid is influenced by information asymmetry between the participants, we should observe a significant correlation between the residuals of the two regressions and a negative correlation in absence of private value.

5.2. Sample

5.2.1. *Sample formation*

The sample was derived from three databases. First we identified takeover transactions through the Thomson Financial SDC Platinum database. We targeted successful transactions that occurred between January 1, 1990 and December 31, 2007, involving American public targets and buyers. We included only transactions in the form of mergers, acquisitions of a majority interest, acquisitions of total assets or acquisitions of particular assets.[3] Further, we chose only transactions intended to take control of the company and therefore we require that the buyer hold less than 50% of the shares of the target before the acquisition. We initially observed 5,984 takeovers. Given that we are investigating the premium and its determinants, it is crucial to know the price that the buyer paid to take control of the target. After eliminating transactions for which this information was not available, we obtained a sample of 4,879 takeovers.

[3] We exclude transactions categorized as exchange offers, buybacks, recapitalizations, acquisitions (by the shareholders), acquisitions of remaining interest and acquisitions of partial interest.

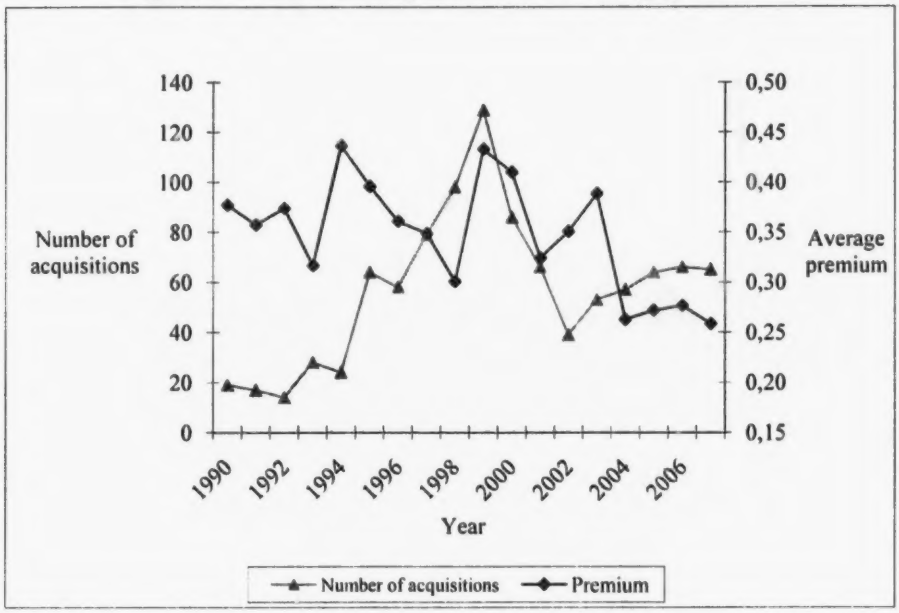
We also eliminated transactions for which information about the transaction was not available in SDC Platinum. Accordingly, 478 observations were removed from the sample because they did not provide information on the indicator variables of public purchase offers, cash payments, hostility and multiple players. We then gathered accounting data concerning the targets and buyers using Compustat to test several hypotheses concerning determinants of the premium. Most accounting information pertained to the end of the most recent fiscal year before the announcement. However, we compiled data concerning sales, tax and deferred investment credits for the year before the most recent fiscal year before the announcement to test our hypotheses concerning growth of the target's sales and the free cash flows of the buyer. Transactions for which accounting data were not available in the periods desired (2990) were eliminated.

Lastly, we obtain the sequence of share prices of the target and the buyer from the database of the *Center for Research in Security Prices* (CRSP). These prices were used to calculate the premium, the recent return on the buyer's stock and the runup of the target. We eliminated transactions for which information related to share prices of the parties involved was not available (385). We obtained a final sample of 1,026 takeover transactions for which all the data required to construct the variables of our model are available.

5.2.2. *Description of the sample*

Figure 1 presents the number of transactions and the average premium for each year of the study period.

Figure 1: Number of acquisitions and average premium



Half of the acquisitions in our sample occurred between 1996 and 2001. This period is marked by a concentration of transactions because it captures the wave of acquisitions that ended in 1999. This wave was caused in particular by increased consolidation of industries powered by globalization and a favorable economic environment. The periods of 1990 to 1995 and 2002 to 2007 were calmest regarding takeovers, with 16.18% and 33.53% respectively of the acquisitions in our sample. The largest number of transactions—129—occurred in 1999; this coincides with the peak of the wave of acquisitions identified in the literature. The year 1992 was the calmest, with a total of 14 takeovers.

5.3. Statistical description of the premium

The dependent variable of our model, namely the premium paid by the buyer, varies considerably. The average premium is 34.62%, and the standard deviation is 30.46%. The maximum premium paid by a buyer is 223.65%, whereas the lowest premium is –160.94%,

which signifies that in some cases the buyers paid a price below the share value to acquire the target.[4]

Figure 1 shows that the average premium paid by buyers varies over time. The average premium peaked in 1994 and 1999, at 43%. The large number of acquisitions that characterize the peak of the wave reached in 1999 thus coincided with substantial premiums. Since 2004, the average premium has been lower than that observed in previous years.

5.4. Statistical description of the explanatory variables

Table 2 contains a statistical description of all of the explanatory variables of the model. Several variables have large standard deviations. We consequently include the median to ensure that the interpretations based on the mean are not biased. Our first finding is that the rumors preceding the announcement of an offer create an average runup of 8.4%, which indicates a strong positive reaction by the market. This cumulative abnormal return on the target's stock is nonetheless lower than that identified by Schwert (1996) for the period of 1975 to 1991, which was 13.3%. The runup varies considerably in our sample, and although it is generally positive, the minimum runup is -241%. The sensitivity analysis proves, however, that the result related to the runup is not influenced by this extreme value. Further, the market value of the target is on average almost four times higher than the book value. This mean market-to-book ratio probably does not reflect the reality of our sample owing to the presence of high extreme values. By comparison, the median market-to-book ratio is 2.13. The growth in median sales of the target is about 10%, which signals good financial health.

The typical buyer is in good financial health, with considerable free cash flows and solid stock return performance. The average performance of the buyer's stock in the six months preceding the runup period is 16%. Further, buyers and targets have a similar median market-to-book ratio, 1.83 vs. 2.13. The leverage of the targets and buyers is similar because debt represents 18% to 19% of their assets respectively. Given the similar debt structure of the parties to the transaction,

[4] Given the significant variations in the premium, we perform a sensitivity test on the extreme values and present the results in Section 7. We also perform a sensitivity test on the extreme values for each of the independent variables related to the characteristics of the target and of the buyer.

it is improbable that the financial synergies identified by Slusky and Caves (1991) dictate the choice of the target and the price paid. The largest differences are seen in company size: on average, the targets are about one quarter of the size of the buyers. The transactions included in our sample are often friendly and are negotiated with the managers of the target. Hostile offers represent barely 2% of acquisitions, and public purchase offers occur in 20% of the cases. Further, a potential buyer is rarely faced with competing offers because the presence of several buyers has been identified in only 5% of cases. Transactions paid entirely in cash represent 32% of takeovers.

Four percent of the buyers in our sample held a block of the target's stock before the announcement of the offer. This result differs from Betton, Eckbo and Thorburn (2009), who conclude that between 1973 and 2002, 13% of the buyers held shares of the target before the announcement. The difference in the percentages is explained mainly by two factors aside from the fact that the variable used by Betton, Eckbo and Thorburn (2009) includes all the shares held before the announcement, rather than only blocks of shares. They examine data beginning twelve years earlier than that of our sample, and demonstrate that buyers held substantially more shares of the target before the announcement during this period. In addition, their sample comprises public and private buyers, whereas our sample consists uniquely of public buyers. Private buyers hold more of the target's shares before the announcement than do public buyers, which may also explain the difference. 22% of the blockholders come from the same state, which is similar to the 20% result of Kang and Kim (2008). 17% are from a regulated industry.

To ensure that there is no perfect linear relation between the independent variables in (6), we estimated the matrix of correlation coefficients. Results are presented in Appendix A. Our variables do not present a collinearity problem. The highest significant correlation, 39%, is observed between the leverage of the target and the leverage of the buyer. Indebted buyers are therefore more inclined to bid on targets that possess considerable leverage, which hampers financial synergies posited by Slusky and Caves (1991). The second highest positive correlation is between the purchase offer and cash payment, 36.7%. Potential buyers therefore seem to believe that the optimal strategy consists in pairing the public purchase offer with cash payment.

Table 2: Statistical description of the independent variables

This table presents the descriptive statistics of the independent variables, namely the mean, standard deviation, median, minimum and maximum. These statistics were calculated based on our sample of 1026 takeover transactions between 1996 and 2007.

Independent variable	Mean	Standard deviation	Median	Minimum	Maximum
1) Target					
Runup	0.084	0.285	0.067	-2.409	1.677
Market-to-book	3.826	19.758	2.125	-95.472	536.733
Sales growth	0.238	1.029	0.103	-0.891	23.781
Size	5.385	1.756	5.244	0.105	11.696
Leverage	0.178	0.214	0.104	0.000	1.722
2) Buyer					
Return on stock	0.160	0.564	0.099	-0.807	13.948
Free cash flows	0.072	0.106	0.082	-0.824	0.358
Market-to-book	2.430	2.011	1.834	0.354	29.699
Relative size	0.254	0.377	0.117	0.000	4.046
Leverage	0.187	0.174	0.153	0.000	1.040
3) Transaction					
Public purchase offer	0.196	0.397	0	0	1
Cash Payment	0.316	0.465	0	0	1
Hostility	0.019	0.138	0	0	1
Multiple players	0.052	0.221	0	0	1
4) Information asymmetry					
Blockholders	0.040	0.196	0	0	1
5) Instruments					
Intrastate	0.22	0.42	0	0	1
Intrastate* performance	0.013	0.109	0	-1.473	0.616
Regulated industry	0.17	0.375	0	0	1

6. Results

This section presents the univariate results, namely the profile of informed transactions. We then test the presence of asymmetric information and the empirical validity of several other determinants of the premium using the ordinary least squares, 2SLS, 3SLS, and FML methods. We also confirm our main result, related to information asymmetry, using the tests by Dionne, Gouriéroux, and Vanasse (2001) and Chiappori and Salanié (2000).

6.1. Univariate results: Profile of informed transactions

Table 3 presents the means and medians of the variables studied according to the information of the buyer. We distinguish informed and uninformed transactions. A transaction is informed when the buyer holds a block of shares of the target before the announcement. The statistics elucidate differences between transaction types. We confirm these differences by performing the Mann-Whitney U test of the equality of medians.[5] The null hypothesis of this test stipulates that the data of informed transactions and those of uninformed transactions originate from independent samples with equal medians.

Te premium paid by an uninformed buyer is about twice as high as that paid by an informed buyer. This statistical result supports the idea that information asymmetry between buyers influences the premium paid considerably. The difference between the premiums is significant at 1%. At first glance, the additional information possessed by a buyer that holds a block of shares seems to be advantageous because it lowers the premium. Further, the fact that the informed buyer pays a lower premium implies that potential buyers do not consider the private value of the target important.

Further, the median runup is markedly lower for informed transactions (-1.7%) than for uninformed transactions (7.2%), which signifies that investors respond less favorably to rumors of an acquisition by an informed buyer. The null hypothesis of equality of medians is rejected at 5%. The statistical results elucidate some characteristics of buyers that hold a block of shares of the target before the announcement. Not only are their free cash flows significantly lower than

[5] We performed the Jarque-Bera test distinctly on each of the variables. The results indicate that none of the variables is normally distributed. We consequently opted for a non-parametric test.

those of uninformed buyers, but their median market-to-book ratio is statistically lower. The market therefore overvalues the assets of informed buyers less strongly. Further, on average buyers bid on larger targets when they hold a block of shares. But the difference is not statistically different according to the equality of medians.

Table 3: Profile of informed and uninformed transactions

This table presents the mean and median of the independent variables of our model for transactions in which the buyer holds at least 5% of the shares of the target before the announcement (informed), and for transactions in which the buyer does not have this percentage of the shares before the announcement (uninformed). The results of the Mann-Whitney U test of equality of medians are also presented. ***,**, * indicate that the null hypothesis of equality of medians is rejected at the level of confidence of 1%, 5% and 10% respectively.

	Mean		Median		
	Informed transactions	**Uninformed transactions**	**Informed transactions**	**Uninformed transactions**	**Equality of medians**
Premium	0.182	0.353	0.163	0.340	no***
Independent variable					
1) Target					
Runup	0.002	0.087	-0.017	0.072	no**
Market-to-book	3.875	3.824	1.995	2.129	yes
Sales growth	0.207	0.240	0.085	0.104	yes
Size	5.576	5.377	5.700	5.238	yes
Leverage	0.218	0.176	0.134	0.101	yes
2) Buyer					
Return on stock	0.141	0.161	0.085	0.099	yes
Free cash flows	0.063	0.072	0.066	0.083	no*
Market-to-book	1.941	2.450	1.519	1.846	no*
Relative size	0.313	0.251	0.117	0.118	yes
Leverage	0.222	0.185	0.169	0.152	yes
3) Transaction					
Public purchase offer	0.341	0.190	0	0	
Cash Payment	0.341	0.315	0	0	
Hostility	0.073	0.017	0	0	
Multiple players	0.049	0.052	0	0	
Number of observations	41	985			

We observe that informed buyers opt more often for a public purchase offer than do uninformed buyers. This type of approach, however, is not universal among informed buyers: it is used on average in 34% of the cases. Manifestations of hostility are also more frequent when the transactions are informed, but are nonetheless atypical (7.3%). Of the 41 blockholders who won the bid, 33% were from the same state as the target, while the corresponding percentage for all winners is 22.5%. The mean of the premium for blockholders in the same state that won the bid is 16.2% while the average premium is 34.62%.

6.2. Regression analysis

The results of the regressions, presented in Table 4, are consistent with the theories found in literature on mergers and acquisitions. Our results support the markup pricing hypothesis formulated by Schwert (1996), whereby potential buyers adjust their offer to movements in the share price of the target triggered by rumors of a transaction. In our model, the premium is higher when the cumulative abnormal return of the target in the two months preceding the announcement increases. This relation is significant at 1% in all models. The target is therefore revalued considerably when there is a runup in the share price.

Our results are also consistent with the findings of Morck, Shleifer and Vishny (1988). Targets that perform poorly command a higher premium because buyers can replace the managers and thus increase the firm value. For the transactions in our sample, a decrease in the growth of the sales of the target in the year preceding the announcement triggers a premium increase with a level of confidence of 10% (or more). Thus, fragile financial health, which can be associated with slowed growth in sales, does not seem to impede the negotiating power of the targets. Rather, buyers are more interested in the potential of a target with weaker performance.

The absolute size of the target also negatively influences the premium, which supports the idea that buyers fear the higher integration costs associated with larger targets. This relation is significant at 10%. Similarly, the size of the target relative to the buyer (Relative size) is also negatively related to the premium, at 5% (or more). The two results pertaining to the size variable are consistent with our hypotheses, and validate the theory of integration costs.

In addition, we observe that the debt level of the target, which directly influences the free cash flows available to the buyer, weakens the buyer's negotiating power. A highly indebted target draws a lower premium from the buyer because of its more fragile financial health. This result, however is not significant as the next two (Buyer Leverage and Buyer Free cash flows). Buyers that possess considerable leverage are not constrained to pay a lower premium because of more intense surveillance by creditors. On the contrary, highly indebted buyers can pay a higher premium. Thus, buyers with considerable leverage seem to benefit from a greater possibility of contracting debt, and may use this advantage to pay a higher premium. We also observe that an increase in the buyer's free cash flows is associated with a higher premium.

Our results are consistent with several hypotheses pertaining to the attributes of the transaction. First, buyers that opt for a public purchase offer pay a higher premium than buyers that negotiate with managers of the target. Advantages linked to the speed of execution of a transaction in the form of a public purchase offer are therefore attenuated by the higher premium that buyers must pay. This positive relation between the premium and choice of a public purchase offer, significant at 5% (or more), is in line with the results obtained by Comment and Schwert (1995), Schwert (2000) and Bange and Mazzeo (2004).

Contrary to our predictions, we observe that transactions paid entirely in cash command a lower premium. The premium paid during cash-based transactions is lower than the premium on share-based transactions. However, this relation is not significant at the usual confidence levels. The tax disadvantages for shareholders of the target associated with the cash payment therefore do not play a significant role in determining the premium. Our results indicate that the shareholders of the target try to avoid uncertainty about the future value of the shares associated with share-based bids.

Like Schwert (2000), we note that hostile transactions are associated with a higher premium. Hostile offers trigger a higher premium than do friendly offers. This relation is significant at a confidence level of 5% (or more) and has a similar degree of influence to that determined by Schwert (2000), who used the definition by SDC Platinum.

The results clearly support our hypothesis that information asymmetry between potential buyers significantly influences the premium paid during an acquisition. The relation identified between the Blockholders variable and the premium is significant at a confidence level of 5% when instrumented (and 1% when not instrumented). This result is consistent with the theoretical and empirical studies (see Hendricks and Porter, 1988; Hong and Shum, 2003; Dionne, St-Amour, Vencatachellum, 2008) that find that information asymmetry between the participants influences the equilibrium price of an auction.

In addition, the coefficient of the Blockholders variable is negative. The premium paid by an informed buyer is lower than that paid by buyers that do not hold privileged information. This difference is explained by the fact that participants that do not hold additional information are afraid of suffering from the winner's curse, and thus withdraw early from the auction, which allows informed buyers to pay a lower premium. The literature review brought to light theoretical and empirical research that demonstrated that the winner's curse prevails when potential buyers do not consider the private value when determining the premium. Thus, our negative coefficient shows that in the auction process leading to an acquisition, the target is appraised based on its common value. Elements such as portfolio synergies or cultural similarities do not seem to be relevant.

The coefficient values of the OLS regressions are quite low when compared with the difference in the premiums observed in Table 3 (52% lower for blockholders). Those of the 2SLS are more representative of the observed differences, even when we apply different robustness tests (Table 6 and Appendix C) indicating that blockholders pay a conditional premium around 70% lower than other bidders.

We also observe that the three instruments are statistically significant in the instrumental equation to explain the presence of blockholders. Further, the p-value of the Sargan test indicates that these instruments are truly exogenous. We thus reject the null hypothesis that the over-identifying assumptions are valid. The Durbin-Wu-Hausman test (Prob > F) confirms the relevance of the

instruments for our analysis. In other words, we do not reject the null hypothesis that the instruments are valid.

Lastly, our model identifies premium determinants more efficiently than other empirical models in the literature do. Our model has an adjusted R^2 of 0.27 for the OLS regression, compared with values of around 0.20 for the models tested by Slusky and Caves (1991), Comment and Schwert (1995), Gondhalekar, Sant and Ferris (2004) and Moeller (2005).

6.3. Model by Dionne, Gouriéroux and Vanasse (2001)

Table 4 also presents the results of the Dionne, Gouriéroux and Vanasse (DGV, 2001) test. After having included the estimated probability that a buyer is informed in our initial model $\left(\mathrm{E}\left(\text{Blockholders}\right)\right)$, we confirm a negative and significant influence of the Blockholders information asymmetry variable at 1%.

6.4. Chiappori and Salanié (2000) test

The results of the Chiappori and Salanié (2000) test (not presented in detail) validate the negative and significant coefficient associated with the Blockholders variable in DGV. The residuals of the regression of the premium on the independent variables, excluding Blockholders, along with those of the regression intended to determine the probability that a participant is informed, are negatively correlated at a level of confidence of 1%. The correlation observed is -0.11. This correlation confirms our hypothesis that information asymmetry between potential buyers influences the premium significantly. In addition, we validate that the relation is negative and consequently that the targets are evaluated based on common value.

Table 4: Results - Determinants of the premium

This table presents the results of the regression of ordinary least squares, 2SLS, 3SLS, FIML and the DGV (2001) model. The total number of observations is 1026. ***, **, * indicate that the coefficients are significant at 1%, 5%, and 10% respectively. The statistic for the Durbin-Wu-Hausman test is Prob > F and that for the Sargan test is p-value.

	OLS	DGV	2SLS		3SLS		FIML	
	Premium	Premium	Premium	Blockholders	Premium	Blockholders	Premium	Blockholders
1) Information asymmetry								
Blockholders	-0.136***	-0.137***	-0.704**		-0.704**		-0.732**	
Intrastate*performance				-0.153**		-0.165***		-0.164***
Regulated Industry				0.056***		0.059***		0.058***
Intrastate				0.052***		0.048***		0.047***
E(Blockholders)		0.409						
2) Target								
Runup	0.510***	0.527***	0.487***	-0.048**	0.487***	-0.048**	0.486***	-0.048**
Market-to-book	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Sales growth	-0.016**	-0.016**	-0.016*	0.001	-0.016*	0.000	-0.016*	0.000
Size	-0.011**	-0.010*	-0.011*	-0.003	-0.011**	-0.003	-0.011**	-0.003
Leverage	-0.028	-0.036	-0.016	0.017	-0.016	0.017	-0.015	0.017
3) Buyer								
Return on stock	-0.001	-0.001	0.000	0.002	0.000	0.002	0.000	0.002
Free cash flows	0.095	0.099	0.089	0.053	0.089	0.057	0.088	0.056
Market-to-book	0.001	0.002	-0.001	-0.002	-0.001	-0.002	-0.001	-0.002
Relative size	-0.066***	-0.071***	-0.060**	0.014	-0.060**	0.015	-0.059**	0.015
Leverage	0.044	0.032	0.060	0.031	0.060	0.030	0.061	0.030
4) Transaction								
Public purchase offer	0.049**	0.034**	0.070***	0.046***	0.070***	0.046***	0.071***	0.046***
Cash payment	-0.030	-0.028	-0.032	-0.001	-0.032	-0.001	-0.032	-0.001
Hostility	0.151**	0.110**	0.209***	0.108**	0.209***	0.108**	0.212***	0.108**

	OLS	DGV	2SLS		3SLS		FIML	
	Premium	Premium	Premium	Blockholders	Premium	Blockholders	Premium	Blockholders
Multiple player	-0.009	0.000	-0.022	-0.019	-0.022	-0.018	-0.023	-0.018
Constant	0.372***	0.355***	0.394***	0.017	0.394***	0.018	0.396***	0.018
R^2	0.2730	0.2725	0.6305	0.0812				
Sargan test				0.5477				
Durbin-Wu-Hausman test			0.03148					
Number of observations	1,026	1,026	1,026	1,026	1,026	1,026	1,026	1,026

Table 5: Robustness tests – Dependent variable and Logit

This table presents the results of the robustness test done with a 60-day premium, namely the price offered/price-60). The sample comprises 1024 takeover acquisitions in each case. The table also illustrates the sensitivity of the results to extreme values of the premium by eliminating values situated beyond the 1st and 99th percentiles. The sample is reduced to 1,005 observations. Finally, the table presents the results for the estimation of the Blockholders equation using the Logit model with 1,026 observations. ***,**, * indicate that the coefficients are significant at 10%, 5%, and 1% respectively. The statistic for the Durbin-Hu-Hausman test is Prob > F and that for the Sargan test is p-value.

	2SLS		2SLS Extreme values		OLS		2SLS Logit	
	Premium 60	Blockholders	Premium	Blockholders	Premium 60 Extreme values		Premium	Blockholders
1) Information asymmetry								
Blockholders	-0.930***		-0.701***		-0.155***	-0.125***	-0.605***	
Intrastate*performance		-0.154***		-0.163***				-2.333**
Regulated Industry		0.057***		0.057***				1.243***
Intrastate		0.052***		0.054***				1.129***
2) Target								
Runup	0.450***	-0.047**	0.388***	-0.051**	0.482***	0.414***	0.491***	-1.381**
Market-to-book	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
Sales growth	-0.009	0.001	-0.009	0.001	-0.009	-0.009	-0.016**	0.020
Size	-0.008	-0.002	-0.014***	-0.002	-0.007	-0.013**	-0.011**	-0.034
Leverage	-0.022	0.018	-0.002	0.021	-0.039	-0.015	-0.018	0.527
3) Buyer								
Return on stock	-0.019	0.002	-0.002	0.003	0.019	-0.003	0.000	0.047
Free cash flows	0.124	0.055	0.083	0.057	0.132	0.078	0.090	1.579
Market-to-book	-0.010*	-0.002	-0.002	-0.002	-0.007	0.000	-0.001	-0.152
Relative size	-0.058*	0.015	-0.056**	0.015	-0.068**	-0.063***	-0.061***	0.207
Leverage	0.074	0.031	0.049	0.026	0.052	0.037	0.057	0.890
4) Transaction								
Public purchase offer	0.066**	0.046***	0.069***	0.049***	0.038	0.048***	0.066***	1.189***
Cash payment	-0.025	-0.001	-0.033	-0.003	-0.022	-0.030*	-0.031	0.008

Hostility	0.200**	0.108	0.208***	0.106**	0.122*	0.150***	0.199***	1.393*
Multiple player	-0.041	-0.019	-0.025	-0.019	-0.023	-0.010	-0.020	-0.281
Constant	0.406***	0.016	0.424***	0.013	0.375***	0.397***	0.390***	-4.076***
R^2	0.5426	0.0816	0.6838	0.0840	0.208	0.254	0.2708	0.1527
Sargan test		0.1791		0.4543				0.4584
Durbin-Wu-Hausman test	0.00839		0.00684				0.0058	
Number of observations	1,024	1,024	1,005	1,005	1,024	1,005	1,026	1,026

7. Robustness tests

The variables of our initial model were constructed based on the most pertinent calculation methods found in the finance literature. Other variables could have been used to test the hypotheses. In this section, we perform robustness tests on the dependent variable and the independent variables to validate our results. We also perform sensitivity tests on the extreme values of the dependent variable and the independent variables. All robustness regressions are performed with the OLS and the 2SLS models. The results are then compared with the corresponding model in Table 4. Finally, we test for the functional form of the structural equation by estimating the logit model.

7.1. Dependent variable and Logit model

7.1.1. *Definition of the dependent variable*

Initially, we define the premium as a logarithm of the ratio of the price offered to the share price of the target 42 business days before the announcement of the offer. Similar empirical studies employ different temporal points of comparison for the premium paid. We validate our results by comparing the price offered with the share price of the target 60 days before the announcement, as did Betton and Eckbo (2000). The Premium 60 columns in Table 5 show the results. Our model remains robust when the 60-day premium is used. With a few exceptions, the coefficients keep their signs, order of magnitude and level of confidence.

7.1.2. Testing sensitivity to extreme values of the premium

Given that the descriptive statistics demonstrated a considerable standard deviation of the premium, we validate that our results are not attributable to the presence of extreme values in the dependent variable. We tested the sensitivity of the model to extreme values by eliminating the acquisitions for which the premium value is situated beyond the 1st and 99th percentiles. The results shown in Table 5 (Extreme values) are in line with those of the initial model. Almost all variables keep their sign and magnitude.

7.1.3. Logit model for instrumental equation

We also tested the functional form of the structural equation by estimating a logit equation for Blockholders instead of ordinary least squares. The results in Table 5 indicate that the functional form of first-stage regression does not affect the consistency of the second-stage estimates as well the significance of the different tests, when compared to those of 2SLS in Table 4.

7.2. Independent variables

7.2.1. *Definition of the independent variables*

We also validate that the results are not attributable to the method used to construct the independent variables. Tables 6 and 7 show the results of these robustness tests.

Sales growth

We use the **Return on equity** of the target, defined as the ratio of income before extraordinary items to the book value of the equity, to reflect the past performance of managers of the target rather than sales growth. This variable supports the hypothesis that the acquisition of poorly managed targets is motivated by realizable gains if the current managers are replaced (Cudd and Duggal, 2000). The coefficient of return on equity is not significant in Table 6 (2SLS) but is significant in Table 7 (OLS).

Financial synergies

We confirm the results associated with leverage of the parties to the transaction by replacing long-term debt with **Total liabilities**. For the indebtedness of the target (T leverage), the influence on the premium remains negative and non-significant. Regarding the buyer's leverage (B leverage), the use of **Total liabilities** doubles the positive coefficient and makes it significant at 5%

Company size

We confirm that a small target draws a higher premium because of lower integration costs. We obtain a negative and significant coefficient for the size of the target (**Size market value**), which is defined as the logarithm of the market value of common shares outstanding. This alternative size variant creates a slightly lower coefficient, significant at 1% rather than 5%. Further, the robustness test done on the relative size variable (Relative size II) corroborates our initial results. By comparing total assets of the target with those of the buyer, we estimate a negative coefficient. However, it is no longer significant.

Hostility

The robustness tests done on the hostility variable are satisfactory. First, we created an indicator variable that takes the value of 1 when the offer is unsolicited (**Unsolicited offer**), i.e. when the offer comes as a surprise to the Board of Directors of the target and no recommendation is formulated. We confirm the positive and significant impact of this form of hostility on the premium (Hostility I). Nonetheless, the coefficient is reduced by half and becomes significant at 5% rather than 1%. Further, the use of a "Poison pill" by the target, a defense method often associated with hostility, has a positive and significant influence on the premium (Hostility II).

Again, the coefficient of Blockholders remains negative and significant when we apply different definitions for the independent variables.

7.2.2. *Extreme values of the independent variables*

Appendix B shows the results obtained for the OLS model when extreme values beyond the 1st and 99th percentiles were eliminated. Results for the 2SLS are presented in Appendix C. Most of our results are robust to the sensitivity test of the extreme values on the independent variables related to the characteristics of the target. The elimination of extreme values of the runup, size of the target and leverage influences the results very little. The effect of the sensitivity test is more evident in the market-to-book ratio of the target, which becomes negative and significant (not for 2SLS). This result implies that buyers pay more for undervalued targets. The greatest influence of

the sensitivity test is seen in the target's sales growth. The coefficient is no longer significant, whereas two variables become significant--free cash flows of the buyer and the variable indicating a cash-based transaction (not for 2SLS). Thus the extreme values notably influence the results related to sales growth and the market-to-book ratio of the target.

Further, we observe that our results are also robust to the sensitivity test of extreme values done on the independent variables related to the characteristics of the buyer. Apart from the coefficients of return on stock and leverage of the buyer, which change signs but remain non-significant, the results related to the characteristics of the buyer are not influenced by extreme values. In all cases, the coefficient of the Blockholders variable is not significantly affected.

Table 6: 2SLS Robustness tests – Independent variables

We perform robustness tests on several independent variables with the 2SLS method. Regarding the characteristics of the target, we test for sales growth, size and leverage. We also test the robustness of the relative size, leverage of the buyer, and hostility of the transaction (Unsolicited offer and Poison pill). Results of the structural equation are not presented but are available. The statistic for the Durbin-Wu-Hausman test is Prob > F and that for the Sargan test is p-value.

	2SLS (Sales growth)	2SLS (T leverage)	2SLS (B leverage)	2SLS (T size)	2SLS (Hostility I)	2SLS (Hostility II)	2SLS (Relative size)
1) Information asymmetry							
Blockholders	-0.641*	-0.663**	-0.716**	-0.730**	-0.697**	-0.766**	-0.685**
2) Target							
Runup	0.487***	0.492***	0.483***	0.477***	0.487***	0.487***	0.494***
Market-to-book	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Sales growth		-0.016*	-0.016*	-0.015*	-0.016*	-0.016*	-0.016*
Return on equity	**-0.001**						
Size	-0.011**	-0.010*	-0.015**		-0.012**	-0.010*	-0.013**
Size market value				**-0.018*** **			
Leverage	-0.022		-0.015	-0.022	-0.016	-0.010	-0.010
Total liabilities		**-0.032**					
3) Buyer							
Recent performance	0.000	-0.001	0.001	0.001	-0.001	-0.001	-0.002
Free cash flows	0.085	0.085	0.104	0.112	0.087	0.086	0.100
Market-to-book	-0.002	-0.002	0.001	0.001	-0.001	-0.001	0.000
Relative size	-0.061**	-0.062**	-0.052**	-0.049**	-0.061**	-0.061**	
Relative size II							**-0.004**
Leverage	0.057	0.058		0.066	0.056	0.055	0.037
Total liabilities			**0.100****				
4) Transaction							
Public purchase offer	0.067**	0.070***	0.069***	0.069**	0.074***	0.074***	0.071***
Cash payment	-0.031	-0.034	-0.033	-0.033	-0.034	-0.035	-0.026
Hostility	0.204***	0.205***	0.211***	0.223***			0.212***

	2SLS (Sales growth)	2SLS (T leverage)	2SLS (B leverage)	2SLS (T size)	2SLS (Hostility I)	2SLS (Hostility II)	2SLS (Relative size)
Unsolicited offer					**0.157****		
Poison pill						**0.264****	
Multiple player	-0.019	-0.022	-0.021	-0.021	-0.052	-0.002	-0.028
Constant	0.391***	0.403***	0.365***	0.422***	0.398***	0.394***	0.390***
R^2	0.6412	0.6387	0.6294	0.6280	0.6313	0.6163	0.6323
Sargan test	0.5263	0.5914	0.4030	0.5287	0.5707	0.6464	0.7468
Durbin-Wu-Hausman test	0.09031	0.05154	0.02933	0.02493	0.03128	0.02050	0.04020
Number of observations	1,026	1,026	1,026	1,026	1,026	1,026	1,026

Table 7: OLS Robustness tests – Independent variables

We perform robustness tests on several independent variables with the OLS method. Regarding the characteristics of the target, we test for sales growth, size and leverage. We also test the robustness of the relative size, leverage of the buyer, and hostility of the transaction (Unsolicited offer and Poison pill). The statistic for the Durbin-Wu-Hausman test is Prob > F and that for the Sargan test is p-value.

	OLS (Sales growth)	OLS (T leverage)	OLS (B leverage)	OLS (T size)	OLS (Hostility I)	OLS (Hostility II)	OLS (Relative size)
1) Information asymmetry							
Blockholders	-0.125***	-0.134***	-0.138***	-0.137***	-0.136***	-0.135***	-0.139***
2) Target							
Runup	0.506***	0.514***	0.507***	0.502***	0.510***	0.512***	0.517***
Market-to-book	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Sales growth		-0.016**	-0.016**	-0.015**	-0.016**	-0.016**	-0.016**
Return on equity	**-0.006****						
Size	-0.010**	-0.009*	-0.013***		-0.010**	-0.010*	-0.013***
Size market value				**-0.017*****			
Leverage	-0.030		-0.029	-0.034	-0.028	-0.025	-0.021
Total liabilities		**-0.051**					
3) Buyer							
Recent performance	0.000	-0.001	0.000	0.001	-0.001	-0.001	-0.003
Free cash flows	0.089	0.088	0.108	0.118	0.094	0.094	0.110
Market-to-book	0.000	0.000	0.002	0.003	0.001	0.001	0.002
Relative size	-0.068***	-0.070***	-0.061***	-0.056**	-0.068***	-0.068***	
Relative size II							**-0.004**
Leverage	0.042	0.042		0.049	0.042	0.039	0.020
Total liabilities			**0.081****				
4) Transaction							
Public purchase offer	0.048**	0.051**	0.048**	0.047**	0.054**	0.051**	0.051**
Cash payment	-0.030	-0.033*	-0.031	-0.031	-0.032	-0.032	-0.023
Hostility	0.152***	0.151***	0.152***	0.163***			0.157***
Unsolicited offer					**0.086***		

	OLS (Sales growth)	OLS (T leverage)	OLS (B leverage)	OLS (T size)	OLS (Hostility I)	OLS (Hostility II)	OLS (Relative size)
Poison pill						**0.165***	
Multiple player	-0.007	-0.009	-0.008	-0.007	-0.021	0.006	-0.016
Constant	-0.125***	-0.134***	0.347***	-0.137***	0.372***	0.369***	0.367***
R^2	0.273	0.274	0.275	0.279	0.271	0.271	0.267
Number of observations	1,026	1,026	1,026	1,026	1,026	1,026	1,026

8. Conclusion

We modeled the corporate acquisition process as an English ascending auction owing to the presence of potential buyers. Our main objective was to analyze whether information asymmetry between potential buyers has a significant impact on the premium paid during acquisitions. Our second objective was to validate several determinants of the premium paid, which were identified in the empirical literature. This objective follows from the rare consensus in the research on the significance of the determinants related to the characteristics of the target, the buyer and the transaction.

In addition, our study enriches the literature by offering a new sample, which comprises 1026 takeover transactions in the United States between 1990 and 2007. Notably, our sample is very recent and encompasses data from several sources, which allows us to simultaneously test determinants related to the target, the buyer and the transaction process. Further, the sample precisely captures the wave of acquisitions that peaked in 1999, which indicates that it is representative of the takeover market during the period studied.

Our empirical analysis yields interesting conclusions related to the corporate acquisition process. First, we observed that information asymmetry between participants influences the premium paid during a takeover significantly. Informed buyers, that are buyers that hold at least 5% of the shares of the target before the announcement of the offer, pay a significantly lower conditional premium (around 70% lower) than do buyers that do not possess privileged information. Further, the analysis of this negative coefficient provides deep insight into the way the target is valued. Informed buyers pay a lower premium because the participants that do not hold private information are afraid of suffering the winner's curse (winning by bidding too high) and either withdraw from the auction early or do not participate. The winner's curse prevails among uninformed buyers when participants do not factor private value into their valuation of the target. Our negative coefficient thus shows that in the auction process leading to an acquisition, the participants consider the target's common value exclusively. They do not use personal criteria such as portfolio synergies or cultural similarities in their valuation

The negative and significant influence of information asymmetry on the premium paid is confirmed using several models and robustness tests on the specification of the dependent and independent variables and on the extreme values of all variables of interest.

Our empirical analysis also enabled as to affirm several determinants of the premium identified in the literature. Notably, our result supports the idea that the runup in the share price of the target, triggered by rumors preceding the announcement of the offer, leads buyers to re-value the target. Buyers are not certain that they possess the information that drives this movement in the stock and therefore prefer to adjust their offer accordingly. We also observed that buyers pay more for targets with weaker performance because of the large potential gains associated with targets in difficulty. Further, our results support the theory of integration costs, which stipulates that buyers prefer smaller targets because of their lower absorption costs. The size of the target and relative size to the buyer are therefore negatively related to the premium paid. Lastly, a buyer that opts for a public purchase offer or a hostile takeover generally pays more to acquire the target. Our study therefore better equips the parties involved in the takeover process to set the preliminary price of the transaction and thus enhance their growth strategies.

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Appendix A: Matrix of correlation coefficients of independent variables

This table presents the correlation coefficient between the independent variables of our model.
*indicates a level of significance greater than or equal to 5%

	T Runup	T Market-to-book	T sales growth	T Size	T Leverage	B Return on stock	B Free cash flows	B Market-to-book	Relative size	B Leverage	Public purchase offer	Cash payment	Hostility	Multiple players	Blockholders (not instrumented)
Characteristics of the target															
Runup	1.000														
Market-to-book	-0.010	1.000													
Sales growth	0.046	0.042	1.000												
Size	-0.140*	0.032	-0.040	1.000											
Leverage	0.022	0.122*	0.057	0.257*	1.000										
Characteristics of the buyer															
Return on stock	0.018	0.017	0.015	-0.033	-0.031	1.000									
Free cash flows	0.068*	0.015	0.025	0.006	-0.081*	-0.061*	1.000								
Market-to-book	0.030	0.072*	0.123*	-0.173*	-0.1420*	0.118*	0.072*	1.000							
Relative size	-0.105*	-0.019	-0.011	0.253*	0.112*	0.052	-0.148*	-0.139*	1.000						
Leverage	0.003	-0.028	0.006	0.1529*	0.3900*	0.002	-0.099*	-0.214*	0.220*	1.000					
Transaction															
Public purchase offer	0.040	-0.031	0.012	-0.063*	-0.037	-0.056	0.054	-0.037	-0.097*	-0.061*	1.000				
Cash payment	-0.026	-0.020	-0.031	-0.165*	-0.205*	-0.076*	0.124*	-0.060*	-0.192*	-0.122*	0.367*	1.000			
Hostility	-0.019	-0.009	-0.018	0.128*	0.033	-0.022	0.008	-0.005	0.000	-0.007	0.161*	-0.005	1.000		
Multiple players	-0.014	-0.020	-0.025	0.113*	0.018	-0.040	0.007	-0.037	0.086*	-0.006	0.096*	-0.016	0.190*	1.000	
Information asymmetry															
Blockholders (not instrumented)	-0.058	0.000	-0.006	-0.006	0.038	-0.007	-0.017	-0.050	0.032	-0.042	0.075*	0.011	0.079	-0.003	1.000

Appendix B: OLS Sensitivity test of the extreme values of the independent variables

This table presents the results of the initial OLS model and the results of this sensitivity tests on the extreme values of each of the independent variables related to the characteristics of the target and the buyer. For each of the independent variables we tested the sensitivity of the model to extreme values by eliminating acquisitions for which the value of the independent variable is situated beyond the 1st and 99th percentiles. For each regression, we present the coefficients and their p-value. ***,**, * indicate that the coefficients are significant at 10%, 5% and 1% respectively. Tested variables are indicated at the top of each column.

Independent variable	Initial model	Runup	Market-to-book	Sales growth	Size	T-Leverage
1) Information asymmetry						
Blockholders	-0.136***	-0.144***	-0.123***	-0.140***	-0.138***	-0.148***
2) Target						
Runup	0.510***	**0.453*** **	0.507***	0.495***	0.508***	0.517***
Market-to-book	0.000	0.000	**-0.005***	0.000	0.000	0.000
Sales growth	-0.016**	-0.012	-0.016*	**-0.011**	-0.016**	-0.018**
Size	-0.011**	-0.013***	-0.011*	-0.011**	**-0.010***	-0.012**
Leverage	-0.028	0.007	-0.032	-0.039	-0.025	**0.017**
3) Buyer						
Return on stock	-0.001	-0.002	0.003	-0.005	-0.003	-0.001
Free cash flows	0.095	0.118	0.099	0.153*	0.091	0.100
Market-to-book	0.001	0.001	0.003	0.001	0.001	0.001
Relative size	-0.066***	-0.074***	-0.065***	-0.065***	-0.066***	-0.066***
Leverage	0.044	0.022	0.049	0.056	0.044	0.021
4) Transaction						
Public purchase offer	0.049**	0.057***	0.046**	0.052**	0.049**	0.056**
Cash payment	-0.030	-0.030	-0.032	-0.033*	-0.032	-0.033
Hostility	0.151**	0.147**	0.152**	0.152***	0.149**	0.149**
Multiple players	-0.009	-0.014	-0.011	-0.011	-0.008	-0.011
Constant	0.372***	0.387***	0.382***	0.373***	0.372***	0.377***
Adjusted R^2	0.273	0.204	0.269	0.268	0.270	0.281
Number of observations	1,026	1,004	1,004	1,004	1,004	1,015

Appendix B: OLS Sensitivity test of the extreme values of the independent variables (continued)

Independent variable	Initial model	Return on stock	Free cash flows	Market-to-book	Relative Size	B-Leverage
1) Information asymmetry						
Blockholders	-0.136***	-0.139***	-0.127***	-0.134***	-0.133***	-0.132***
2) Target						
Runup	0.510***	0.500***	0.528***	0.508***	0.514***	0.515***
Market-to-book	0.000	0.000	0.000	0.000	0.000	0.000
Sales growth	-0.016**	-0.011	-0.014*	-0.017**	-0.004	-0.016**
Size	-0.011**	-0.011**	-0.009*	-0.010**	-0.010**	-0.010**
Leverage	-0.028	-0.036	-0.031	-0.025	-0.031	-0.024
3) Buyer						
Return on stock	-0.001	**0.008**	-0.001	0.000	0.000	0.000
Free cash flows	0.095	0.039	**0.031**	0.083	0.096	0.088
Market-to-book	0.001	0.001	0.003	**0.008**	0.000	0.000
Relative size	-0.066***	-0.065***	-0.061***	-0.069***	**-0.085*****	-0.060***
Leverage	0.044	0.035	0.042	0.058	0.041	**-0.016**
4) Transaction						
Public purchase offer	0.049**	0.048**	0.049**	0.048**	0.047**	0.051**
Cash payment	-0.030	-0.032*	-0.026	-0.028	-0.031	-0.028
Hostility	0.151**	0.150***	0.150**	0.150**	0.153**	0.152***
Multiple players	-0.009	-0.010	-0.009	-0.007	-0.006	-0.008
Constant	0.372***	0.383***	0.361***	0.352***	0.372***	0.376***
Adjusted R^2	0.273	0.271	0.284	0.272	0.285	0.285
Number of observations	1,026	1,004	1,004	1,004	1,005	1,015

Appendix C: 2SLS Sensitivity test of the extreme values of the independent variables

This table presents the results of the initial 2SLS model and the results of this sensitivity tests on the extreme values of each of the independent variables related to the characteristics of the target and the buyer. For each of the independent variables we tested the sensitivity of the model to extreme values by eliminating acquisitions for which the value of the independent variable is situated beyond the 1st and 99th percentiles. For each regression, we present the coefficients and their p-value. ***,**, * indicate that the coefficients are significant at 10%, 5% and 1% respectively. Tested variables are indicated at the top of each column. Results of the instrumental equation are not presented but are available.

Independent variable	Initial model	Runup	Market-to-book	Sales growth	Size	T-Leverage
1) Information asymmetry						
Blockholders	-0.704**	-0.588**	-0.575**	-0.598**	-0.719**	-0.514**
2) Target						
Runup	0.487***	**0.426*** **	0.489***	0.476***	0.484***	0.503***
Market-to-book	0.000	0.000	**-0.004**	0.000	0.000	0.000
Sales growth	-0.016*	-0.011	-0.016*	**-0.013**	-0.016*	-0.018**
Size	-0.011*	-0.013***	-0.012**	-0.011**	**-0.011***	-0.012**
Leverage	-0.016	0.016	-0.028	-0.032	-0.013	**0.014**
3) Buyer						
Return on stock	0.000	-0.002	0.002	-0.006	-0.002	-0.001
Free cash flows	0.089	0.111	0.089	0.150*	0.084	0.095
Market-to-book	-0.001	-0.001	0.002	-0.002	-0.001	0.000
Relative size	-0.060**	-0.069***	-0.057**	-0.059**	-0.060**	-0.062***
Leverage	0.060	0.036	0.057	0.063	0.060	0.039
4) Transaction						
Public purchase offer	0.070***	0.074***	0.064**	0.066***	0.070***	0.071***
Cash payment	-0.032	-0.032	-0.032	-0.034	-0.034	-0.037
Hostility	0.209***	0.192***	0.200***	0.202***	0.208***	0.186***
Multiple players	-0.022	-0.025	-0.020	-0.031	-0.022	-0.019
Constant	0.394***	0.406***	0.400***	0.393***	0.396***	0.390***
Adjusted R^2	0.6305	0.6597	0.6545	0.6563	0.6256	0.6678
Sargan test	0.5477	0.4530	0.4045	0.5900	0.5878	0.4964
Durbin-Wu-Hausman test	0.03148	0.06539	0.19058	0.06281	0.02549	0.14084
Number of observations	1,026	1,004	1,004	1,004	1,004	1,015

Appendix C: 2SLS Sensitivity test of the extreme values of the independent variables (continued)

Independent variable	Initial model	Return on stock	Free cash flows	Market-to-book	Relative Size	B-Leverage
1) Information asymmetry						
Blockholders	-0.704**	-0.628**	-0.796***	-0.754**	-0.707**	-0.663**
2) Target						
Runup	0.487***	0.480***	0.500***	0.481***	0.491***	0.494***
Market-to-book	0.000	0.000	0.000	0.000	0.000	0.000
Sales growth	-0.016*	-0.011	-0.015*	-0.017**	-0.003	-0.016*
Size	-0.011*	-0.012**	-0.010*	-0.011**	-0.011*	-0.010**
Leverage	-0.016	-0.026	-0.017	-0.012	-0.017	-0.013
3) Buyer						
Return on stock	0.000	**0.010**	-0.002	0.001	0.000	0.000
Free cash flows	0.089	0.031	**0.036**	0.074	0.094	0.082
Market-to-book	-0.001	0.000	0.001	**0.006**	-0.002	-0.001
Relative size	-0.060**	-0.060**	-0.052*	-0.070***	**-0.069****	-0.054**
Leverage	0.060	0.049	0.058	0.078	0.057	**-0.008**
4) Transaction						
Public purchase offer	0.070***	0.066***	0.074***	0.072***	0.069**	0.070***
Cash payment	-0.032	-0.034	-0.026	-0.031	-0.032	-0.029
Hostility	0.209***	0.202***	0.218***	0.213***	0.211***	0.205***
Multiple players	-0.022	-0.021	-0.025	-0.018	-0.021	-0.021
Constant	0.394***	0.404***	0.393***	0.379***	0.395***	0.395***
Adjusted R^2	0.6305	0.6526	0.6158	0.6218	0.6288	0.6448
Sargan test	0.5477	0.3486	0.3830	0.5081	0.5082	0.5001
Durbin-Wu-Hausman test	0.03148	0.04865	0.00810	0.03507	0.02960	0.03815
Number of observations	1,026	1,004	1,004	1,004	1,005	1,015